LEADING Semiconductors for Wireless Handsets

ADI 40 years 1965 2005

ANALOG DEVICES

Introduction

In the last few years, wireless handsets have evolved from business tools and luxury items into everyday consumer devices. New capabilities have emerged beyond simple voice communications, including text messaging, downloadable ring tones, email, Web browsing, color displays, cameras, enhanced audio, and multimedia messaging services. And the increased data rates offered by new standards such as EDGE and 3G will enable even more features and services to mobile users.

Analog Devices is a leading supplier of the technology inside wireless handsets. From digital signal processors to analog interfaces to RF transceivers, Analog Devices can provide the entire semiconductor content of a 2G, 2.5G, 2.75G, or 3G mobile terminal. The SoftFone® platform, complemented by the award-winning Othello® series of direct-conversion transceivers, provides wireless terminal device manufacturers with utmost flexibility and scalability to easily customize user features and options entirely in software, while incorporating breakthrough advancements in power consumption, cost, and size.

ADI's products are among the most innovative and are field and market-proven. Through its relationship with TTPCom of Cambridge, England, which supplies the protocol stack software for ADI's GSM/GPRS, EDGE and W-CDMA/UMTS digital baseband processors, Analog Devices introduced the first open-market chipset to achieve Full Type Approval for GSM and GPRS. In addition, ADI's Othello and SoftFone chipsets and reference designs are supported by a wide range of third party vendors and are the choice of many leading OEM and ODM handset producers.

As the wireless terminal market continues to grow and evolve, with multiple customer segments and air interfaces, Analog Devices is committed to continuing to offer the highest performance and most innovative and flexible solutions available.

Significant Milestones in ADI's Cellular Product Activities

1990: Analog Devices 16-bit DSP processors chosen by several GSM handset manufacturers

1992: AD7002 GSM analog baseband IC introduced

1993: Analog Devices teams up with TTPCom to develop GSM software

1994: AD20msp410 chipset announced, including analog and digital baseband functions in 3 chips

1996: AD20msp415 second-generation GSM (2-chip) baseband chipset announced

1997: AD6432 radio (IF transceiver) announced

1998: AD20msp425 third-generation GSM baseband chipset announced

1998: Analog Devices establishes European Wireless Applications Center in Aalborg, Denmark

1999: Othello RF chipset becomes first open-market direct-conversion GSM radio solution

2000: AD20msp430 SoftFone baseband chipset announced

2001: Othello One™ single-chip GSM/GPRS RFIC announced

2002: Analog Devices adds new SoftFone GSM/GPRS baseband processors

2003: Blackfin SoftFone for EDGE announced

2003: Analog Devices establishes Wireless Applications Center in Shanghai, China

2004: Analog Devices launches chipsets for 3G, TD-SCDMA and W-CDMA standards: SoftFone-LCR and SoftFone-W

2004: Analog Devices becomes world's #3 supplier of GSM/GPRS/EDGE baseband processors

2005: Analog Devices introduces world's smallest quad-band GSM/GPRS radio (Othello-G)

► Inside This Brochure

Analog Devices Wireless Chipsets

This brochure includes information on Analog Devices complete chipsets for GSM, GPRS, EDGE, and 3G (W-CDMA, TD-SCDMA) handsets and terminals. Each chipset consists of a digital baseband processor, analog baseband processor, and RF transceiver IC. In some cases, several choices are available, depending on the feature set of the end product under development.

Development Tools

All Analog Devices wireless chipsets are fully supported by a complete set of development tools and software.

Complementary Products

In addition, Analog Devices offers numerous complementary products for multimedia, user-interface, and connectivity functions in handsets using Analog Devices or other manufacturers' chipsets. These are not standard-specific, and can greatly enhance the feature set of a wireless handset. Additional products and functions are in development. Please contact your local Analog Devices sales office for functions not included in this brochure.

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Analog Devices handset ICs are available in Pb-free, RoHS-compliant packaging.

SoftFone Chipsets for GSM/GPRS Voice/SMS Handsets

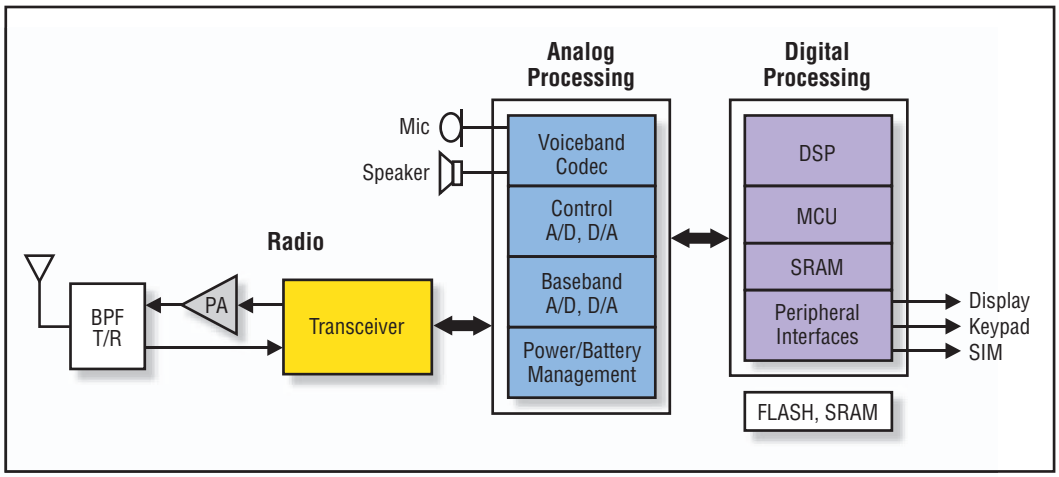
Overview

The Analog Devices SoftFone platform enables a cellphone manufacturer to develop a broad range of phones from a common architecture and technology base. Features and capabilities can be easily added in software and integrated with the proven protocol-stack software provided by TTPCom of Cambridge, England.

The SoftFone Voice/SMS chipset is shown below. This basic platform offers low BOM cost, long standby time, and an easy upgrade path to new features.

Development Tools and Support

The SoftFone chipset for Voice/SMS handsets is fully supported by the VisualFone Development System. GSM/GPRS protocol stack and applications software are available from TTPCom of Cambridge, England.



Othello-G (AD6548)	Typhoon-A (AD6533)	Athena (AD6525)
Direct-conversion receiver	Complete analog baseband processor	ADSP-218x DSP core
Virtual-IF transmitter	On-chip system power management	ARM7TDMI MCU
On-chip VCOs, loop filter	Small package size	On-chip SRAM
850/900/1800/1900 MHz		Available in several configurations of zero-wait-state memory
Integrated LDOs		
1.5 cm^2 PC area		

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

SoftFone Chipsets for GSM/GPRS Featurephones

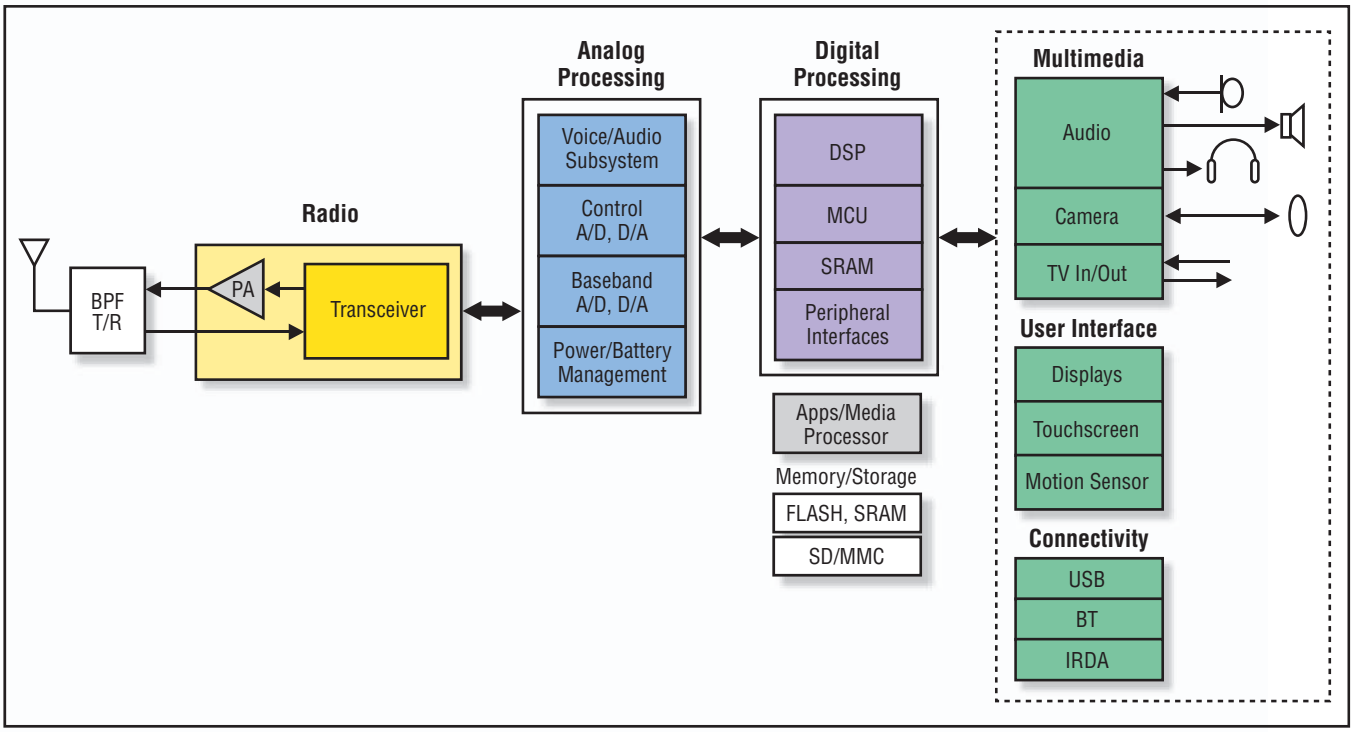
Overview

The Analog Devices SoftFone chipset for Featurephones is shown below. This platform offers a wide range of features that can be added by software or by a simple substitution of the baseband analog processor.

The Hermes and Ares families of digital baseband processors offers a rich feature set, including USB, multiple serial and parallel ports for display and camera interfaces, polyphonic ringtone generation in software, and full Class 12 GPRS operation. The user can choose either an ARM7TDMI or ARM926EJ-S MCU depending on the features/application processing speed required.

The Typhoon family of analog baseband processors provides a range of audio features, from basic voice operation to game/ringtones, hands-free/speakerphone, and MP3-quality stereo audio with integrated headphone/speaker drivers. In addition, the Typhoon devices include a complete set of voltage regulators and system-monitoring/control A/D and D/A converters for power management and low power, high performance baseband A/D and D/A converters.

The Othello-G direct conversion transceiver completes the platform, offering a low BOM cost, dual-, tri-, or quad-band radio in 1.5 cm^2 of board area. The Othello-G transceiver includes all VCOs, loop filters, and an on-chip crystal oscillator. It also includes on-chip voltage regulators for direct-to-battery connection.



Radio	Analog Baseband Processor				Digital Baseband Processor		
Othello-G (AD6548)		**Typhoon-A (AD6533)**	**Typhoon-B (AD6537B)**	**Typhoon (AD6535)**		**Hermes (AD6527/ AD6528/ AD6529)**	**Ares (AD6758)**
850/900/1800/1900 MHz	**Baseband A/D, D/A**	✓	✓	✓	**DSP**	ADSP-218x	ADSP-218x
Integrated VCOs	**Voiceband codec**	✓	✓	✓	**MCU**	ARM7TDMI	ARM926EJ-S
Direct-conversion receiver	**Power management**	✓	✓	✓	**SRAM**	Up to 2 Mb	Up to 2 Mb
Virtual-IF transmitter	**Control A/D, D/A**	✓	✓	✓	**USB**	✓	✓
1.5 cm^2 board area	**48 kHz audio channels**		1	2	**SD/MMC**	✓	✓

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

► Blackfin SoftFone Chipset for EDGE/GSM/GPRS Featurephones

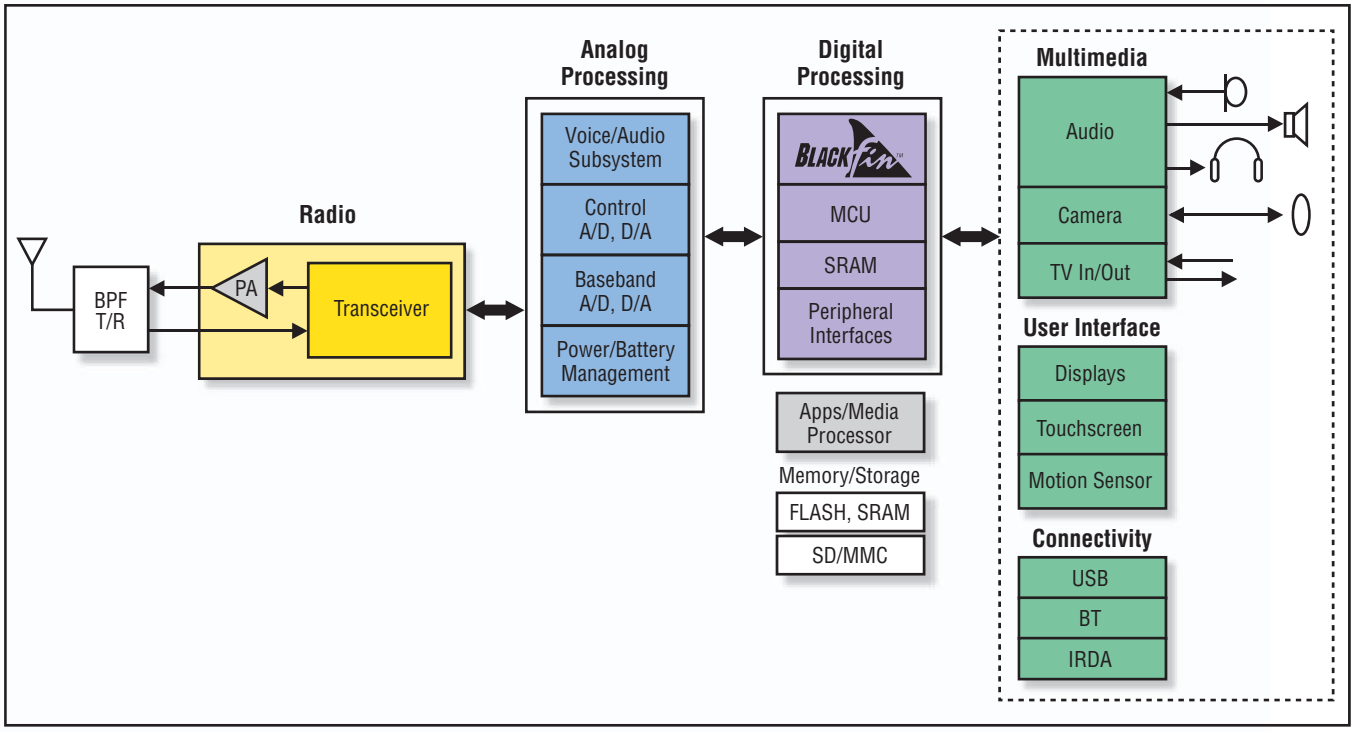
Overview

The Blackfin SoftFone for EDGE chipset is shown below. This chipset offers full Class 12 EDGE operation while maintaining excellent talk and standby time performance. This combination of high performance and low power is enabled by the Blackfin Processor, used for the voice coding and signal equalization tasks. The digital baseband processors offer enough processing speed to enable a wide range of features to be added in software, usually eliminating the need for a separate application processor or by a simple substitution of the baseband analog processor.

The Monaco and LeMans families of digital baseband processors offers a rich feature set, including USB, multiple serial and parallel ports for display and camera interfaces, polyphonic ringtone generation in software, and full Class 12 EDGE operation. The user can choose either an ARM7TDMI or ARM926EJ-S MCU depending on the features/application processing speed required.

The Typhoon-E analog baseband processors provides audio resources including a voice band codec with multiplexed inputs for car kits and hands-free/speakerphone operation, and high quality stereo D/A converters for MP3 stereo audio playback. In addition, the Typhoon-E device includes a complete set of voltage regulators and system-monitoring/control A/D and D/A converters for power management and low power, high performance baseband A/D and D/A converters.

The OthelloOne Plus and Othello-ET combination uses direct conversion receiver technology and efficient polar modulation for the transmit function to provide a low BOM cost radio supporting dual-, tri-, or quad-band 8-PSK as well as on-chip voltage regulators for direct-to-battery connection.



Radio	Analog Baseband Processor	Digital Baseband Processor		
Othello-E (AD6546)	**Typhoon-E (AD6555)**		**Monaco (AD6531/AD6532)**	**LeMans (AD6900)**
850/900/1800/1900 MHz	Baseband A/D, D/A	**DSP**	Blackfin	Blackfin
Integrated VCOs	Voiceband codec	**MCU**	ARM7TDMI	ARM926EJ-S
Direct-conversion receiver	Power management	**SRAM**	Up to 4 Mb	Up to 4 Mb
Polar Modulator transmitter	Control A/D, D/A	**USB**	1.1	OTG
	Stereo audio	**SD/MMC**	✓	✓

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

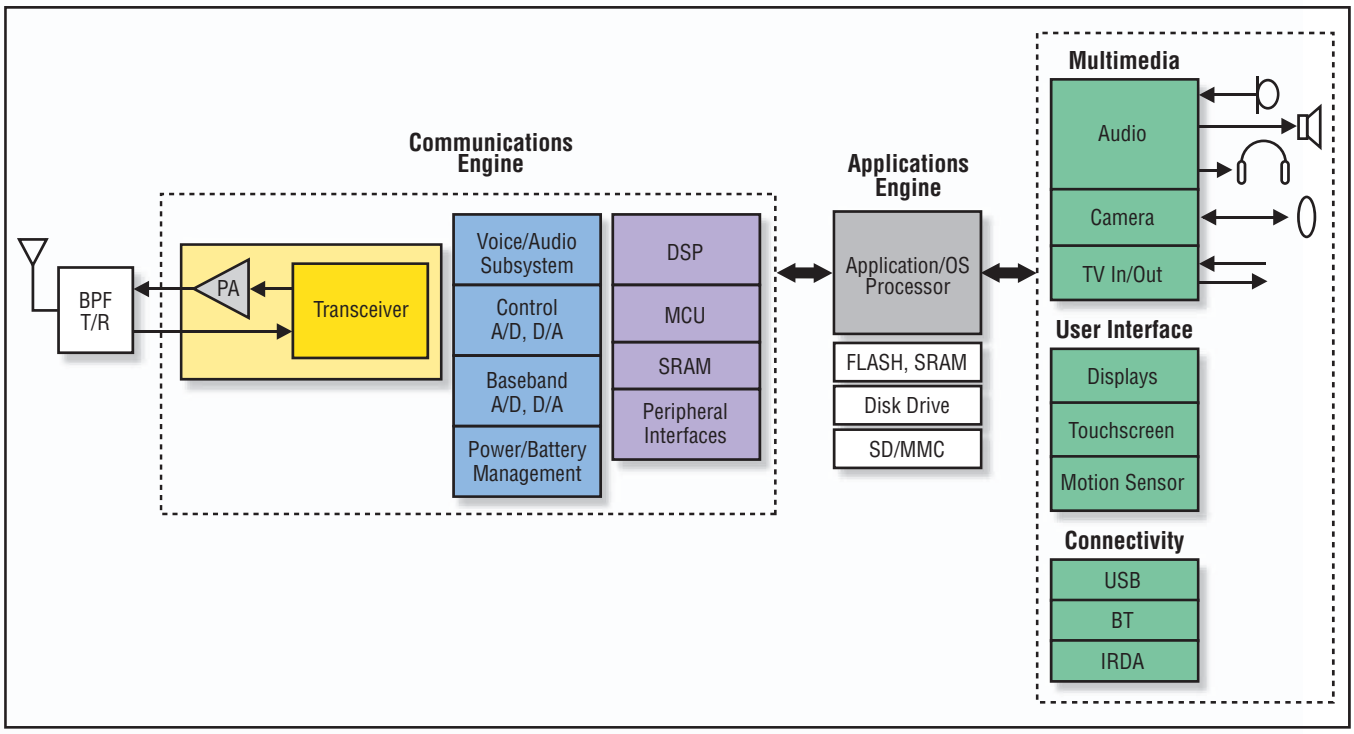
SoftFone Chipsets for Smartphones/Wireless PDAs

Overview

Analog Devices SoftFone chipsets provide a low risk, low power solution to the wireless communications engine requirements in Smartphones and wireless-enabled PDAs. Such devices use a specialized processor to run a high level operating systems, such as Symbian, Microsoft Windows Mobile, and Linux.

SoftFone platform can be chosen for either GPRS or EDGE operation, and the user is free to choose the operating system, application processor, and peripherals. The interface between the application/OS processor and the communications engine is usually handled through a high speed serial interface.

Analog Devices also offers a wide range of products for multimedia, user interface, and connectivity features for smartphones and wireless PDAs.



	GPRS	EGPRS
Data Rate (max)	57.6 kbps	236.8 kbps
Class	12	12
Recommended chipset		
Digital baseband	Athena (AD6526)	Monaco (AD6531/AD6532)
Analog baseband/power management	Typhoon-A (AD6533)	Typhoon-E (AD6555)
Radio	Othello-G (AD6548)	Othello-E (AD6546)

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

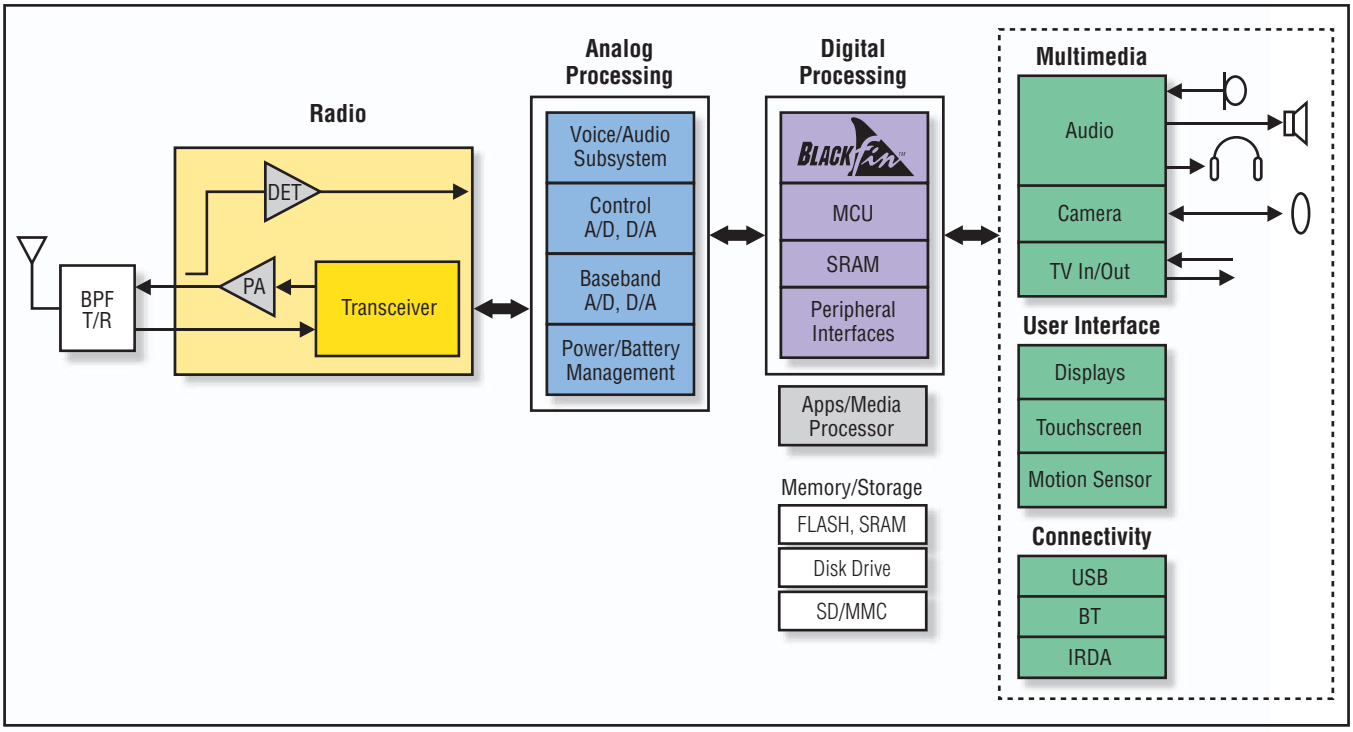
► SoftFone-W Chipset for 3G W-CDMA/UMTS Handsets

Overview

The SoftFone-W chipset provides a complete solution for 3G handsets based on the W-CDMA and UMTS standards. Combining the high performance and low power of the Blackfin Processor with advanced mixed-signal and RF technology results in a platform with low cost and long battery life.

The chipset supports dual-mode operation with W-CDMA and EDGE (EGPRS) operation. Protocol stack and application software are available from TTPCom of Cambridge, England.

Analog Devices also offers a wide range of complementary products for multimedia, user interface, and connectivity features for 3G handsets.



Radio	Analog Baseband Processor	Digital Baseband Processor
Othello-W (AD6541/AD6547)	**Stratos-W**	**Monza**
Direct-conversion receiver	Dual-mode baseband A/D, D/A	Blackfin Processor
Supports W-CDMA, TD-SCDMA	Voiceband codec	ARM926EJ-S
Variable transmit and receive gain	Power management	Programmable WCDMA logic
Dual-mode W-CDMA/GPRS (with AD6548)	Control A/D, D/A	On-chip SRAM
	Stereo audio	SD/MMC, USB

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

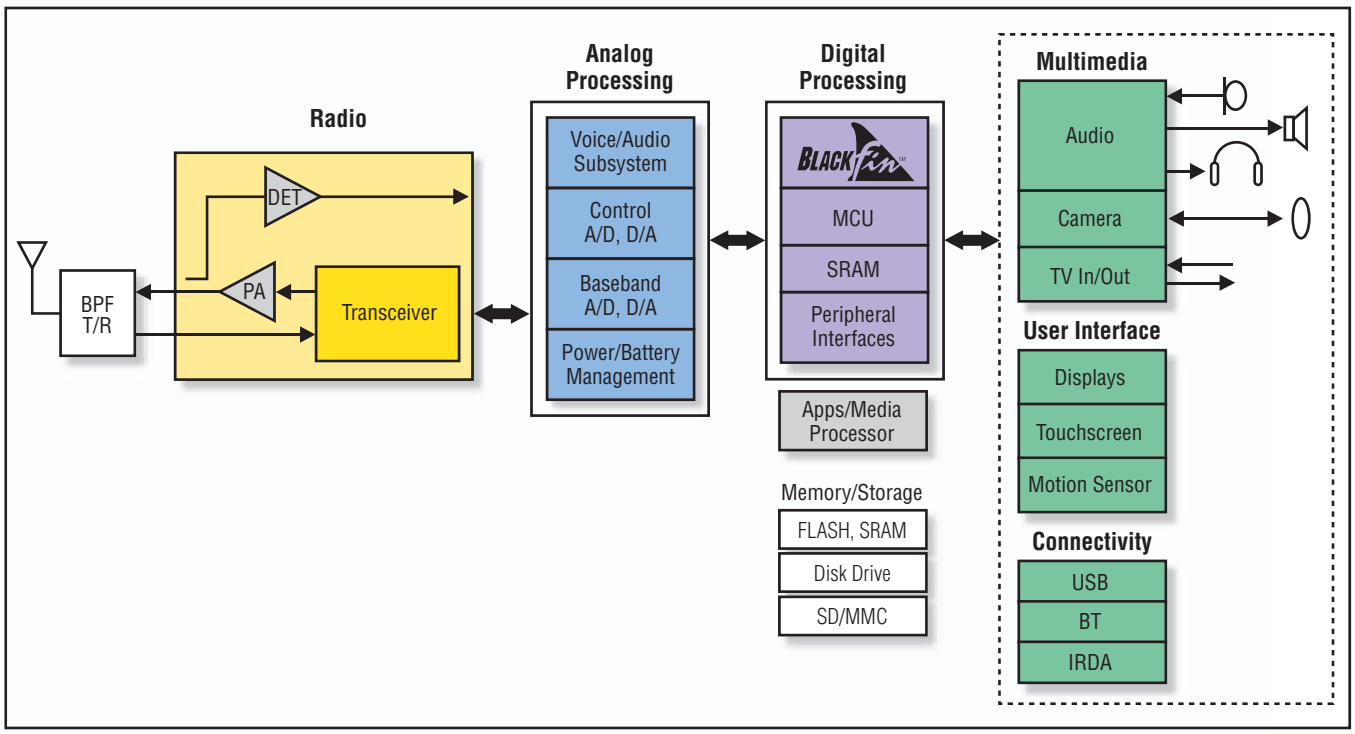
SoftFone-LCR Chipset for 3G TD-SCDMA/LCR Handsets

Overview

The SoftFone-LCR chipset provides a complete solution for 3G handsets based on the TD-SCDMA/LCR standard. Combining the high performance and low power of the Blackfin Processor with advanced mixed-signal and RF technology results in a platform with low cost and long battery life.

The digital baseband processor performs all TD-SCDMA signal-processing tasks, including joint detection and decoding entirely in software. Protocol stack and application software are available from Datang Mobile, the primary developer of the TD-SCDMA standard.

Analog Devices also offers a wide range of complementary products for multimedia, user interface, and connectivity features for 3G handsets.



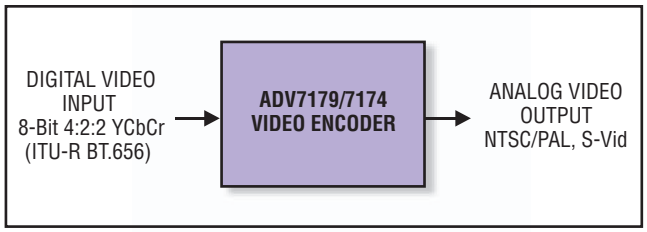
Radio	Analog Baseband Processor	Digital Processor
Othello-W (AD6541/AD6547)	**Stratos-L (AD6854)**	**Monaco-LCR (AD6901)**
Direct-conversion receiver	Dual-mode baseband A/D, D/A	Blackfin Processor
Supports W-CDMA, TD-SCDMA	Voiceband codec	ARM926EJ-S
Variable transmit and receive gain	Power management	Programmable W-CDMA logic
Dual-mode TD-SCDMA/GPRS (with AD6548)	Control A/D, D/A	On-chip SRAM
	Stereo audio	SD/MMC, USB

Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

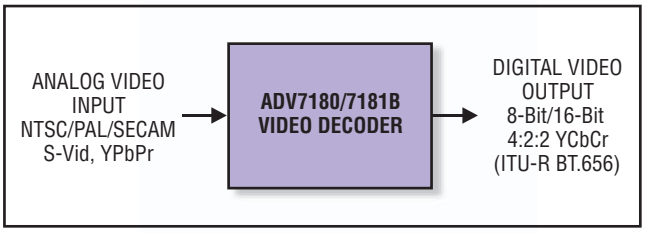
► Complementary ICs for Enhanced Multimedia Handsets

TV/Video Processors

TV/video input and output capabilities are becoming popular features for multimedia cellular terminals. Analog Devices offers several products that make it easy to add TV/video interfaces to a handset.

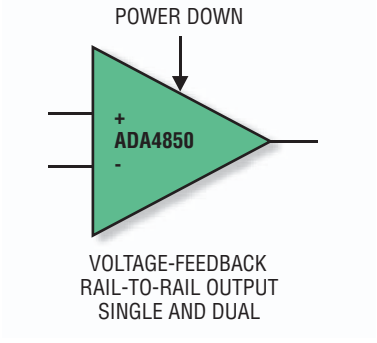


Enables cellular terminals to send captured/stored/streaming video to external display device such as TV, VCR, DVD, or PVR

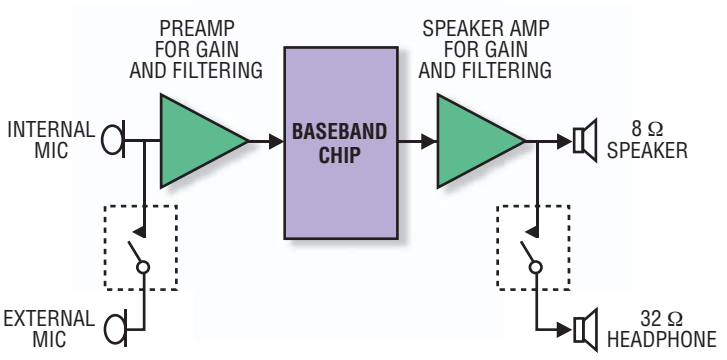


Enables cellular terminals to receive/store video from external source such as VCR, DVD, PVR, DBS tuner, or camcorder.

Video Op Amps for Handsets



Audio Op Amps and Switches for Handset Applications



Mic Preamps	
AD8541	Low power
AD8591	Shutdown feature
AD8692	Low distortion

Analog Switches	
ADG779	SPDT, 2 × SPDT,
ADG836	4 × SPDT available*

Speaker/Headphone Amps	
AD8531	250 mA I_{OUT}, SC70, SOT-23
AD8591	<0.1 µA shutdown current
SSM2211	1.5 W output power

* Please refer to *www.analog.com* for a complete list of all analog switch and multiplexer products

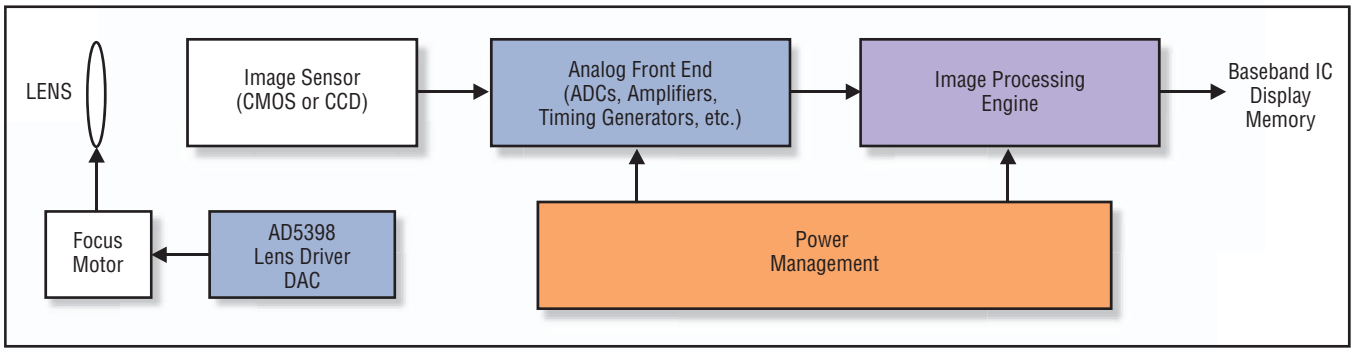
Complete data sheets for all products are available at www.analog.com *or your local Analog Devices sales office.*

► Complementary ICs for Multimedia Handsets

Handset Camera Components

Cameras are now included in virtually all new handsets. The capabilities of these cameras continue to move to high quality digital still camera and camcorder functions, creating the need for components to improve camera performance and features.

Analog Devices, the leader in components for digital still cameras, offers several key components to enhance cellphone cameras. The AD5398 is the smallest, lowest cost solution for autofocus control in camera phones and camera modules.



**Contact sales office for details of Analog Front End,Image Processing, and Power Management Products for cellphone cameras*

Motion Sensors and Micromachined (MEMS) Technology

Micromachined motion sensors can be used for numerous applications in cellular handsets, including tilt correction for compass-equipped phones, camera image stabilization, enhanced user interface, gaming, drop detection, and more. Analog Devices, a world leader in MEMS technology, offers a full range of motion sensors. MEMS switches also show promise for use in RF switching applications. Please contact Analog Devices for more information on MEMS technology for cellular handsets.

Product	Range	Package Size
ADXL320	±5g	4 × 4 × 1.45 mm
ADXL321	±18g	4 × 4 × 1.45 mm
ADXL322	±2g	4 × 4 × 1.45 mm

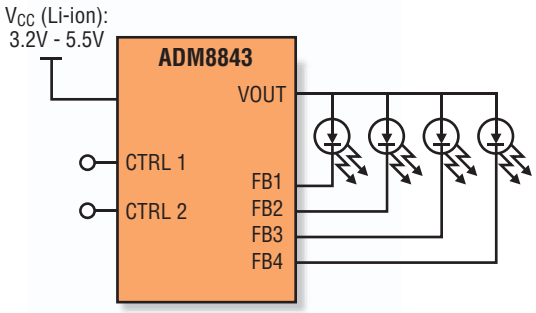
Complete data sheets for all products are available at www.analog.com *or your local Analog Devices sales office.*

► User Interface Components

Display Control ICs

Cellular handsets require specialized devices to enhance the visibility of the display. Analog Devices offers a wide range of ICs for LED driver and LCD panel power requirements. A few representative products are shown here – please contact your local Analog Devices sales office for detailed information on these and other products.

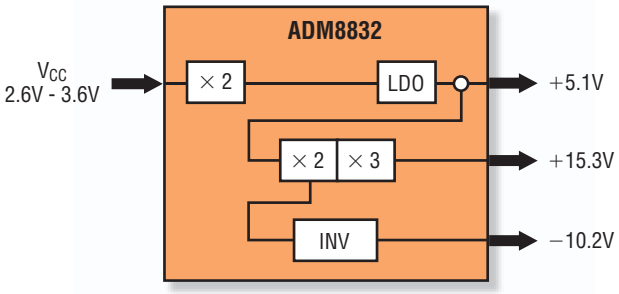
ADM8843 White LED Backlight Driver



ADM8843 Features

- 88% power efficiency
- 3 mm × 3 mm package
- Low power shutdown mode
- Digital PWM brightness control

ADM8832 Charge Pump for Color TFT Panel



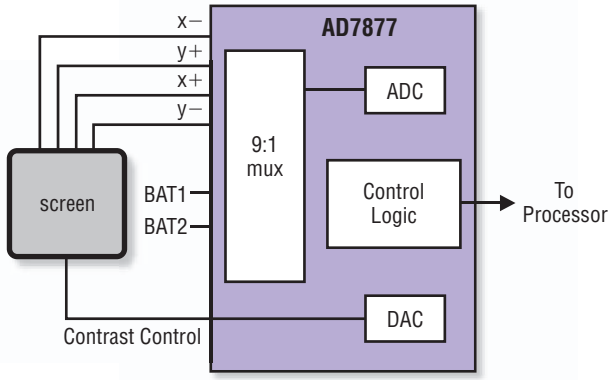
ADM8832 Features

- 3 Output voltages
- Sequenced power-up
- <1 μA shutdown current
- 4 mm × 4 mm package

Touchscreen Interface Controller

Touchscreens provide a user-interface for large-screen-size devices such as wireless PDAs, giving the device the ability to interpret complex commands with a single touch. Analog Devices offers touchscreen interface ICs for both resistive touchscreen (shown below) and capacitive sliders, joypad, and button (contact sales office) interfaces.

AD7877 Touchscreen Controller



AD7877 Features

- 12-Bit ADC with auxiliary inputs
- On-chip contrast DAC
- LCD noise reduction
- 1 μA shutdown current
- 5 mm × 5 mm package

Complete data sheets for all products are available at www.analog.com *or your local Analog Devices sales office.*

► User Interface/Connectivity Components

RF Components

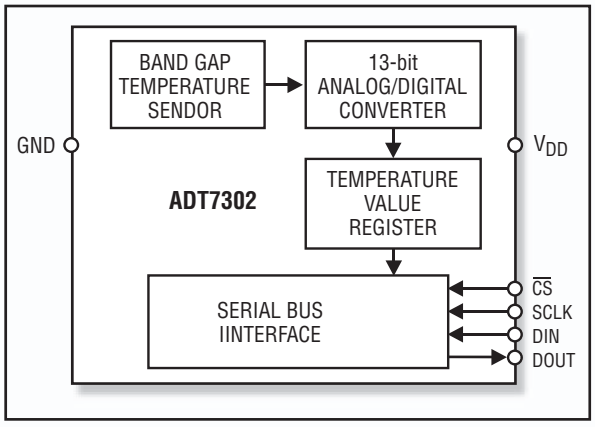
Most cellular handsets require accurate control of transmitter output power. Analog Devices offers a full range of power detectors covering all cellular standards, using both logarithmic (linear-in-dB output) and TruPwr™ rms-responding technology.

	AD8314	AD8315	AD8316	AD8361	AD8311	AD8312	ADL5500
Cellular standard	GSM CDMA WCDMA	GSM EDGE	GSM EDGE	CDMA WCDMA	GSM	GSM CDMA WCDMA	CDMA WCDMA
Dynamic sange, dB	45	50	50	30	50	45	45
Detector type	Log	Log	Log	RMS	Log	Log	RMS
Package size (mm)	3 × 2	3 × 2	3 × 3	3 × 2	1 × 1.5	1 × 1.5	1 × 1

Temperature Sensors

Analog Devices offers a wide variety of temperature-sensing products form simple voltage-output devices to sensors with integrated A/D converters and serial interfaces. Typical devices are listed in the table below.

	TMP05	TMP36	ADT7302	AD7414
Output	Serial digital	Voltage	Serial digital	Serial digital
On-chip A/D	12 bits	—	13 bits	10 bits
Package	SOT-23, SC70	SOT-23	SOT-23	SOT-23



USB, Data/Audio Switches, and Level Translators

Connecting cellular handsets to other devices for data exchange often requires provision for switching wideband USB and/or audio signals with low ON resistance, or a level translator to connect devices operating on different supply voltages. Analog Devices offers a full range of interface devices. A few typical devices used on handsets are shown in the table below. Refer to *www.analog.com* for information on other switch configurations.

	ADG787	ADG3241	ADG3242	ADG3308
Function	Dual 2:1 mux	SPST	2 × SPST	Level Translator
Standard	USB1.1	USB2.0	USB2.0	1.2 V to 5 V
Package	3 × 3 mm LFCSP, 1.5x2 mm WLCSP	SC70, SOT-66	SOT-23	4 × 4 mm LFCSP

Complete data sheets for all products are available at www.analog.com *or your local Analog Devices sales office.*

► Development Tools and Reference Designs

VisualFone Development System

The VisualFone Development System enables users of Analog Devices wireless chipsets to quickly and easily develop, debug, integrate, and test hardware and software for a wide range of wireless devices. The system is PC-based, running under the Windows® environment and can be used with Analog Devices evaluation boards or customer-designed hardware. The system includes software tools for demonstration, evaluation, development, and debug phases of the cellular terminal design process. Combined with the RAM-based SoftFone family of baseband processors, the VisualFone system enables fast time-to-market and easy software/hardware re-use. The VisualFone Development System includes two hardware options. The Anvil Development Motherboard accepts daughter boards for all SoftFone digital baseband, analog baseband, and radio modules. It is supplied with an RS-232 cable for software downloads, a 110/220V power supply, and telephone handset. The Matrix Compact Evaluation Motherboard includes daughterboards with layout-optimized combinations of digital and analog baseband processors, as well as a socket for a layout-optimized radio module. In addition, the Matrix board includes an SD/MMC socket, CMOS camera interface and stereo headset.

Software (on CD-ROM)

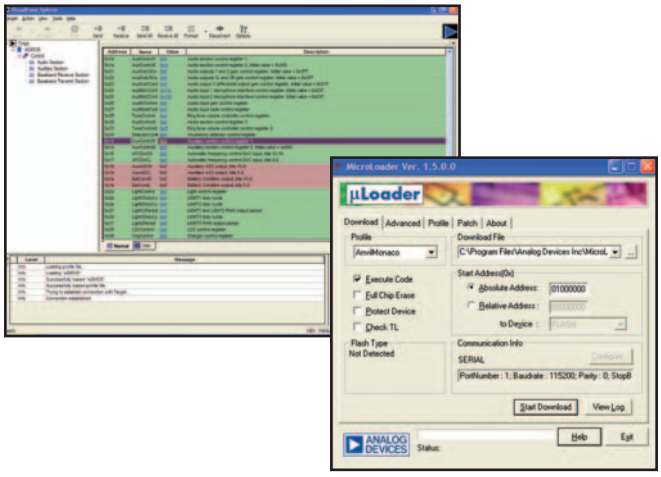
The VisualFone development software suite includes the Forge Development Software, Flash downloader, debugging tools, RF toolkit, and test software.

Reference Designs

The Nova Wireless Engine is a complete reference design for featurephones based on the Hermes digital baseband processor, Typhoon analog baseband processor, and Othello-G transceiver. The capabilities of the basic Nova engine can be easily extended by the addition of graphics coprocessors, application processors, or cameras. The Nova board is intended for mounting in a clamshell or bar-type enclosure and provides a solid basis for a complete line of featurephone products with capabilities defined in software.

Anvil Wireless Development Platform

Matrix Wireless Evaluation Platform



Complete data sheets for all products are available to prequalified handset/terminal developers under Nondisclosure agreement. Contact your local Analog Devices sales office.

► Support Network

Designing a cellular terminal is a complex process, and developers often require support on short notice. Analog Devices is committed to providing that support.

Our Customer Care Group provides whatever technical assistance is needed, from reference design modification involving either analog or digital design to RF PC board layout, and software/hardware integration.

Teams are located in Europe, North America, and Asia to provide local time zone support. Each team includes experts in all facets of cellular terminal design.

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